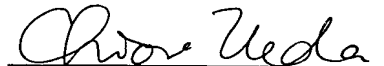




CERTIFICATE OF TRANSLATION

I, Chiori Ueda, c/o IIDA PATENT BUREAU,
11-26, Marunouchi 2-chome, Naka-ku, Nagoya-shi, Aichi-ken, Japan, hereby
certify that to the best of my knowledge and belief the attached English
translation is a true and correct translation of the original document –
Japanese Patent Application No. 2002-375044 – made by me.

This 6th day of July, 2005


Chiori Ueda

[Name of the Document]

Specification

2002-375044

[Title of the Invention]

Occupant Protection Device

[Claims]

[Claim 1]

An occupant protection device comprising a knee-protecting airbag device located in front of an occupant seated in a front passenger's seat for protecting the occupant's knees in the event of collision of the vehicle, a container box located above the knee-protecting airbag device for housing goods, and an interior decoration member surrounding a rear side face of the container box,

the knee-protecting airbag device comprising an airbag inflatable for protecting the occupant's knees, an inflator for supplying inflation gas to the airbag, a case for housing the folded airbag and the inflator, the case being opened rearward, and an airbag cover covering an opening of the case, the airbag cover being openable upon airbag inflation,

the container box comprising a box body opened rearward and a lid openably covering an opening of the box body, wherein:

a region of the interior decoration member around the container box and the airbag cover are made of a single-piece molded part.

[Claim 2]

The occupant protection device as set forth in claim 1, wherein:

the lid of the container box is assembled with the molded part to form a module; and

the lid is mounted on the vehicle by mounting the module on the vehicle.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a vehicle occupant protection device located in front of a front passenger's seat for protecting knees of an occupant seated in the front passenger's seat.

[0002]

[Description of Related Art]

In the prior art, the patent publication 1, for example, shows a device for protecting knees of a vehicle occupant seated in a front passenger's seat which device includes an inflatable airbag for protecting occupant's knees.

[0003]

[Patent Publication 1]

JP 8-80797 A

[0004]

[Problems to be solved by the invention]

However, there is conventionally disposed a container box (or glove box) for housing a car registration, a map and so on in front of the front passenger's seat.

[0005]

When the knee-protecting airbag device and the container box are both located in front of the front passenger's seat, an airbag cover of the knee-protecting airbag device, a lid of the container box, and an interior decoration member surrounding the container box are viewed in front of the front passenger's seat. These members to be exposed to the vehicle's interior desirably have good appearances.

[0006]

The present invention contemplates to solve the above problem, and therefore, has an object to provide an occupant protection device which has an improved appearance in the front of the front passenger's

seat even if a container box is mounted in front of the front passenger's seat while the device aims to protect knees of the occupant seated in the front passenger's seat.

[0007]

[Means of Solving the Problem]

The occupant protection device of the present invention includes a knee-protecting airbag device located in front of an occupant seated in a front passenger's seat for protecting the occupant's knees in the event of collision of the vehicle, a container box located above the knee-protecting airbag device for housing goods, and an interior decoration member surrounding a rear side face of the container box. The knee-protecting airbag device includes an airbag inflatable for protecting the occupant's knees, an inflator for supplying inflation gas to the airbag, a case for housing the folded airbag and the inflator, the case being opened rearward, and an airbag cover covering an opening of the case, the airbag cover being openable upon airbag inflation. The container box includes a box body opened rearward and a lid for openably covering an opening of the box body. A region of the interior decoration member around the container box and the airbag cover are made of a single-piece molded part.

[0008]

In the occupant protection device of the present invention, since the interior decoration member located around the container box except the lid for opening when the container box is used and the airbag cover of the knee-protecting airbag device are formed of a single-piece molded part which is integrally molded, there appears no parting line in the border of the two sections, so that the appearance in the front of the front passenger's seat is improved. Of course, since the lid is separate

from the interior decoration member located around the container box and the airbag cover, when the opening of the box body of the container box is opened/closed, the lid is capable of swinging smoothly in such a manner as to separate from the interior decoration member and the airbag cover. Therefore, the open/close operation is not hindered.

[0009]

Of course, if the knee-protecting airbag device is actuated, the airbag inflates with inflation gas from the inflator, pushes open the airbag cover and protrudes from the case, and then protects knees of a vehicle occupant.

[0010]

In the occupant protection device of the present invention, therefore, although the container box is mounted in front of the front passenger's seat while the device aims to protect knees of the occupant seated in the front passenger's seat, the device has an improved appearance in the front of the front passenger's seat.

[0011]

Moreover, since two components or the interior decoration member located around the container box and the airbag cover of the knee-protecting airbag device are formed into a single-piece component, the number of components is reduced, and working processes and cost for mounting the occupant protection device on the vehicle are reduced.

[0012]

It is desired that the lid of the container box is assembled with the molded part to form a module, and that the lid is mounted on the vehicle by mounting the module on the vehicle.

[0013]

With this arrangement, since the lid is assembled with the molded

part constituting the interior decoration member located around the lid and the airbag cover in advance, a good appearance is easily retained in a parting line between the lid and the interior decoration member and the airbag cover. Consequently, the appearance of the front of front passenger's seat is further improved. Especially, the module constitutes a major part of the front side of the front passenger's seat. Since a great part like this is preliminarily assembled before being mounted on the vehicle, good appearance in the front of front passenger's seat is easily retained.

[0014]

[Mode for Carrying out the Invention]

An embodiment of the present invention will be described with reference to drawings. As shown in Figs. 1 and 2, an occupant protection device S embodying the present invention includes a knee-protecting airbag device 11, a container box 60, and a lower panel 8 surrounding a rear side face of the container box 60 and serving as an interior decoration member. The knee-protecting airbag device 11 is located in front of an occupant M seated in a front passenger's seat for protecting knees K (KL and KR) of the occupant M in the event of a collision of a vehicle. The container box 60 is located above the knee-protecting airbag device 11 for containing goods.

[0015]

Front, rear, left and right in this specification are based on a condition where the occupant protection device is mounted on a vehicle, and are consistent with front, rear, left and right of the vehicle.

[0016]

The lower panel 8 constitutes an instrument panel 6 together with an upper panel 7 located thereabove. The lower panel 8 includes a

substantially rectangular opening 8a in the rear side, and a lid 73 of the container box 60 is located in the opening 8a. The lower panel 8 is a part of a two-color molded part 56 which also integrates the airbag cover 44 extending downward from the lower edge of the opening 8a. The airbag cover 44 is adapted to cover the folded airbag 39 of the knee-protecting airbag device 11, and is extended wider in the transverse direction than the width of the opening 8a. In other words, the two-color molded part 56 encloses the lid 73 of the container box 60 so that the airbag cover 44 region is located below the substantially rectangular opening 8a, and the lower panel 8 region is located above the airbag cover 44 in such a manner as to encircle the opening 8a.

[0017]

As shown in Figs. 5 to 7 and 10, the lower panel 8 is provided at left and right edges in the lower periphery of the opening 8a with pivot sections 8b for pivotally supporting the lid 73 in the open/close operation of the lid 73. Each of the pivot sections 8b supports each of hinge arms 74 located in left and right sides of the lower edge 73b of the lid 73 in a swingable manner by means of pins 9. Each of the pivot sections 8b is provided with a hole 8c for fitting the pin 9 therein.

[0018]

The lower panel 8 is further provided at the front side in the upper periphery with a plurality of mounting members 8b for joinder with the upper panel 7. The mounting members in the embodiment are retaining legs 8d to hook the periphery of the upper panel 7.

[0019]

In the foregoing embodiment, an airbag device 80 for a front passenger's seat for protecting a breast and so on of an upper body of the occupant M in the event of a frontal collision of vehicle is

arranged in an upper region of the instrument panel 6, or in the upper panel 7. The airbag device 80 for a front passenger's seat includes an inflatable airbag 81 for protecting a breast and so on of the upper body of the occupant M, an inflator 82 for feeding the airbag 81 with inflation gas, an airbag cover 83 covering the folded airbag 81 in such a manner as to allow the airbag 81 to deploy upon airbag inflation, and a case 84 for containing the folded airbag 81 and the inflator 82 and holding the airbag cover 83. The airbag cover 83 is so disposed as to close an opening 7a of the upper panel 7. The airbag device 80 is bolt 85 fixed to a bracket 2a formed in a dashboard reinforcement 2. The bolt 85 is fastened with a nut 2b fixed to the bracket 2a.

[0020]

As shown in Figs. 3 and 4, the knee-protecting airbag device 11 in the occupant protection device S according to the embodiment includes a folded airbag 39, an inflator 31 for feeding the airbag 39 with inflation gas, a case 12 opened rearward for containing the folded airbag 39 and the inflator 31, and an airbag cover 44 for covering the vehicle's rear side of the case 12.

[0021]

The inflator 31 is a cylinder-type arranged so that its axial direction may be along the vehicle's left-right direction. The inflator 31 includes a substantially columnar body 32 and a diffuser 33. The body 32 includes a substantially columnar general portion 32a and a small diameter portion 32b projected from an end face of the general portion 32a. There are formed a plurality of gas discharge ports 32c on the outer circumference of the small diameter portion 32b. A connector 36 to which a lead wire 37 is connected for inputting actuating signals is connected to the other end face of the general portion 32a

away from the small diameter portion 32b. The diffuser 33 has a substantially cylindrical shape for covering the inflator body 32. The diffuser 33 is provided at the rear side as mounted on the vehicle with a plurality of gas outlet ports 33a for emitting inflation gas. The diffuser 33 further includes a plurality (two, in the foregoing embodiment) of bolts 33d protruded forward of the vehicle, and a plurality of clamping portions 33c for holding the body 32. To attach the inflator body 32 to the diffuser 33, the body 32 is inserted into the diffuser 33 through an insert hole 33b, from the small diameter portion 32b. Then each of the clamping portions 33c is plastically deformed and pressed onto the outer circumference of the general portion 32a. Thus the body 32 is secured to the diffuser 33. If each of the bolts 33d is inserted into a through hole 17a of bottom wall 17 of the case 12, and then nut 34 is fastened with the bolt 33d, the inflator 31 is secured to the case 12.

[0022]

The inflator 31 is actuated by an actuating signal inputted through the lead wire 37 when an airbag actuating circuit mounted on the vehicle detects a frontal collision of the vehicle. When the actuating circuit detects a frontal collision of the vehicle, the inflator 82 of the airbag device 80 for a front passenger's seat also receives an actuating signal simultaneously.

[0023]

The airbag 39 is formed of flexible woven fabric of polyester, polyamide or the like, and takes a substantially rectangular plate shape as deployed completely, as indicated by double-dotted lines in Figs. 1 and 2. The airbag 39 is transversely wide enough to protect both knees KL and KR of the occupant M. The airbag 39 is configured to locate

its occupant's side wall 40 toward the occupant M, and locate its vehicle body side wall 41 toward the container box 60 when completely deployed. The wall portions 40 and 41 have substantially the same shapes. The airbag 39 is provided in a portion 42 in the vehicle body side wall 41 or at its lower end region as completely deployed with insert holes 42a and an insert hole 42b, as shown in Fig. 4. The insert holes 42a are for inserting through the individual bolts 33 of the inflator 31, and the insert hole 42b is for inserting through the body 32 of the inflator 31. The airbag 39 is attached to the case 12 with the body 32 of the inflator 31 protruded from the insert hole 42b, and with the periphery of the individual insert holes 42a clamped by the diffuser 33 and the bottom wall 17 of the case 12. In other words, the airbag 39 is secured to the bottom wall 17 of the case 12 by the periphery of the insert holes 42a serving as a mounting portion 42.

[0024]

Referring to Figs. 3, 4 and 10, the case 12 is made of sheet metal and includes a box-shaped body 13 and a panel portion 18 extending outward from a rear end of the body 13. The body 13 includes a circumferential wall portion 14 having a substantially square cylindrical shape, a bottom wall 17 closing vehicle's front side of the circumferential wall portion 14, and an opening 13a opened in substantially rectangular shape at the vehicle's rear side. The circumferential wall portion 14 is provided on the outer surfaces of its walls 14a and 14b confronting each other in the vertical direction with a plurality of retainers 15 (15U and 15D) for attaching upper and lower joint walls 47 and 48 of the airbag cover 44 to the case 12.

[0025]

Referring to Fig. 10, each of the retainers 15U located on the

outer surface of the upper wall 14a is formed into a hook shape having substantially Z-shaped section, and is adapted to be inserted into the retaining hole 47a formed on the upper joint wall 47 of the airbag cover 44 and retained thereat. The hooks 15U are located in a plurality of positions (four positions, in the foregoing embodiment) along the transverse direction of the vehicle on the wall 14a.

[0026]

Each of the retainers 15D located on the outer surface of the lower wall 14b is formed into a projection shape having a substantially U-shaped section, and is adapted to be inserted into the retaining hole 48a of lower joint wall 48 of the airbag cover 44. The projections 15D are located in a plurality of positions (four positions, in the foregoing embodiment, refer to Fig. 10) along the transverse direction of the vehicle on the wall 14b. A locking member 16 is inserted into the projections 15D for preventing the projections 15D from coming off from the retaining holes 48a. The locking member 16 includes four bars 16a to be inserted in between the outer surface of the lower joint wall 48 and inner circumferences of the individual projections 15D. The four bars are integrated at the vehicle's front side and secured to the case 12. The locking member 16 is secured to the bottom wall 17 of the case 12 together with the inflator 31 when the inflator 31 is fixed to the case 12 by means of bolt 33d and nut 34.

[0027]

As shown in Fig. 4, the side wall 14c in the circumferential wall portion 14 has an insert hole 14d for inserting through the end of the body 32 of the inflator 31. In the bottom wall 17, there are formed two insert holes 17a for inserting through the bolts 33d of the inflator 31.

[0028]

The panel portion 18 has a substantially flat plate shape elongated in the transverse direction to encircle the opening 13a of the case 12. Here, the case 12 shown in Fig. 10 is constructed by welding two members of a box member 12a and a panel member 12b. The panel member 12b constitutes the panel portion 18, and includes the retainers 15U and 15D to be located on the outer surface of the circumferential wall portion 14 of the body 13. The case 12 is formed of two members of the box member 12a and the panel member 12b so as to reduce kinds of components by that the knee protecting airbag device for a front passenger's seat and a knee protecting airbag device for a driver's seat use the same kind of components. That is, the box member 12a of the case 12 and the inflator 31 are also used for the knee-protecting airbag device for a driver's seat, whereas the panel member 12b and the airbag cover 44 (or the molded part 56) are so configured as to fit in their arrangement positions.

[0029]

The case 12 includes a support section 20 formed in an upper edge region of the panel portion 18, and a support section 21 fixed to a front side of the bottom wall 17 of the body 13. The support sections 20 and 21 are adapted to abut against a lower surface 64a of a lower wall 64 in a box body 61 of the container box 60, and support the lower wall 64 of the box body 61. The support section 20 supports a substantially entire area of a rear end part of the lower surface 64a of the lower wall 64 except the left and right ends, and the support section 21 supports a substantially entire area of a front end part of the lower wall lower surface 64a except the left and right ends. The support section 20 is formed by extending a transversely central

part of the upper edge of the panel portion 18 upward, and the support section 21 is composed of a bracket 22 of sheet metal having a vertically inverted-J shaped section as taken along the front-rear direction of the vehicle and welded to the bottom wall 17.

[0030]

The case 12 further includes two fixers 24 for fixing the box body 61 of the container box 60. As shown in Figs. 3 and 10, the fixers 24 are adapted to fix fixing pieces 68 projected downward from the vicinities of left and right lower ends of the front end of the lower wall 64 of the box body 61 by means of tapping bolts 25. Each of the fixers 24 is provided with a hole 24a for screwing the bolt 25 into. The fixers 24 are formed in the bracket 22.

[0031]

As referred to Figs. 6, 8 and 10, the case 12 includes three joint sections 26 for securing the airbag device 11 to the vehicle body 1. The joint sections 26 are located in positions away from the body 13 in the panel portion 18, and includes joint sections 26A and 26B located in the vicinities of left and right upper edge, respectively, and a joint section 26C located toward right side in the lower edge. Each of the joint sections has a joint hole 26a for inserting a bolt 27 thereinto. The joint sections 26 are bolt 27 fixed to brackets 3 extending from a center brace or a side member of the vehicle body 1, thereby serving to secure the airbag device 11 to the vehicle body 1. Each of the brackets 3 in advance has a nut 3a fixed thereto for screwing the bolt 27 thereinto.

[0032]

Moreover, as referred to Figs. 3, 6 and 10, the panel portion 18 of the case 12 is provided at four positions in the upper periphery of the opening 13a with apertures 18a for inserting the upper joint

wall 47 of the airbag cover 44, and at two positions near left and right edges with apertures 18b for retaining retaining legs 46 of the airbag cover 44 (Fig. 9). Apertures 18c shown in Figs. 6 and 10 are adapted to retain not-shown retaining legs of an undercover 4. Slits 18d shown in Figs. 4 and 6 are for inserting left and right side walls 49 of the airbag cover 44 therethrough.

[0033]

The airbag cover 44 is joined to and supported by the case 12 for covering the vehicle's rear side of the folded airbag 39 and the case 12. The airbag cover 44 is formed of the two-shot molded part 56 integrating the lower panel 8. The vicinity of two doors 52 (52U and 52D) covering the opening 13a of the case 12 at the rear side of the vehicle is of a soft section 57, whereas a remaining region including a general section 45 located at the left and right sides of the soft section 57, and the lower panel 8, is a hard section 58.

[0034]

In the embodiment, the soft section 57 of the two-color part 56 is made from thermo-plastic elastomer of olefin whereas the hard section 58 is made from hard polypropylene which is compatible to the soft section 57 and has a shape-retaining property.

[0035]

The two upper and lower doors 52 (52U and 52D) are formed in a substantially rectangular plate shape, and are provided therearound with a thinned breakable portion 51 of a substantially H-shape as viewed from the vehicle's rear side, as shown in Fig. 1. The breakable portion 51 is so provided at its vehicle's front side face with continuous or intermittent grooves as to easily break when the doors 52U and 52D are pushed by the inflating airbag 39. Thus the doors 52U and 52D are

configured to open upward and downward about integral hinges or hinge lines 53 which are arranged in positions connecting upper ends and lower ends of left and right vertical lines of an H-shape of the breakable portion 51 if the breakable portion 51 breaks when pushed by inflating airbag 39.

[0036]

In the soft section 57 in the periphery of the doors 52U and 52D, there are formed four walls 47, 48, 49 and 49 protruded forward of the vehicle to neighbor the circumferential wall portion 14 of the case 12 in the out side, as shown in Figs. 3, 4 and 10. The upper joint wall 47 located above the case circumferential wall 14 and the lower joint wall 48 located below the wall 14 serve to join the airbag cover 44 to the case 12. The walls 47 and 48 include retaining holes 47a and 48a, respectively, such that the retainers 15 (15U and 15D) of the circumferential wall portion 14 are inserted and retained thereat. The retaining holes 47a and 48a each has a rectangular shape.

[0037]

The general section 45 is adapted to cover the panel portion 18 of the case 12 at the rear side of vehicle, and includes retaining legs 46 at left and right sides in the lower edge. The retaining legs 46 are protruded forward of the vehicle to be inserted into the apertures 18b of the panel portion 18 and retained by the panel portion 18, as shown in Figs. 9 and 10.

[0038]

The container box 60 includes a box body 61 opened rearward of the vehicle, and an openable lid 73 for covering an opening 61a of the box body 61.

[0039]

As shown in Figs. 2, 5, 7, and 10, the box body 61 includes a bottom wall 66 positioned at the vehicle's front side and apart from the opening 61a, and a circumferential wall portion 62 extending rearward of the vehicle from the edge of the bottom wall 66 in a substantially square cylindrical shape. The circumferential wall portion 62 includes an upper wall 63 positioned in an upper side, a lower wall 64 positioned in a lower side, and left and right side walls 65 joining the upper and lower walls 63 and 64.

[0040]

Protruded downward from left and right front edge of the lower wall 64 are the fixing pieces 68 to be fixed to the fixers 24 of the case 12. Each of the fixing pieces 68 is provided with a fixing hole 68a for inserting through the bolt 25. A plurality of (three, in the embodiment) fixing pieces 67 project upward in the vicinity of the front edge of the upper wall 63. The fixing pieces 67 are bolt 71 fixed to the bracket 2c of the reinforcement 2 of the instrument panel. A nut 2d is fixed to the bracket 2c for fastening the bolt 71 thereinto.

[0041]

As shown in Fig. 8, the lower wall 64 of the box body 61 is further provided with a detachable cap 64b for putting in the bolts 27 and fixtures used in the bolt 27 fixing of the joint sections 26A and 26B of the case 12 to the bracket 3 of the vehicle body 1. The left and right side walls 65 are each provided with a recess 69 for accommodating the pivot section 8b of the lower panel 8, as shown in Figs. 5 to 7 and 10.

[0042]

As shown in Figs. 5 to 7 and 10, the lid 73 is provided at its left and right lower edge in the vehicle's front side face with hinge

arms 74 projected forward of the vehicle. The hinge arms 74 are joined with and supported by the pivot sections 8b of the lower panel 8 in a swingable manner, such that the upper edge 73a of the lid 73 rotates in the front-rear direction. The hinge arms 74 include a not-shown damper mechanism such that opening/closing action of the lid 73 may not be performed too rapidly. The lid 73 is position-restricted by abutting against the rear end face of the circumferential wall portion 62 in the box body 61 when closed, and when opened, it is position-restricted by the not-shown damper mechanism.

[0043]

The lid 73 is mounted on the vehicle as a part of a module 10 which is formed by assembling the lid 73 with the molded part 56 integrating the lower panel 8 and the airbag cover 44. To assemble the lid 73 with the molded part 56, the holes 74a in the individual hinge arms 74 are matched with corresponding holes 8c of the pivot sections 8b, and the pins 9 are fitted in the holes 8a and 74a to join the lid 73 with the lower panel 8 in a swingable manner. By attaching the not-shown damper mechanism thereto, the assemblage is complete.

[0044]

To mount the occupant protection device S on the vehicle, the airbag 39 and the inflator 31 are firstly housed in the case 12 of the knee-protecting airbag device 11. More specifically, the inflator 31 preliminarily assembled by the body 32 and the diffuser 33 is put in the airbag 39 so that the bolts 33d are protruded from the insert holes 42a and the end of the inflator body 32 is protruded from the insert hole 42b, and then the airbag 39 is folded up. Subsequently, the airbag 39 is wrapped around by a not-shown breakable wrapping film for keeping the folded-up shape. At this time, the bolts 33d and the end of the

body 32 of the inflator 31 protruded from the insert holes 42a and 42b are taken out from the wrapping film. Other than a resin sheet member, a cloth member such as the woven fabric used to form the airbag 39, a tape member or a string member may be employed as the wrapping film.

[0045]

Thereafter, the inflator 31 is housed in the case 12 together with the folded airbag 39, so that the individual bolts 33d of the inflator 31 are protruded from the insert holes 17a, and the end of the inflator body 32 is protruded from the insert hole 14d. By further fastening not-shown spring nuts with the individual bolts 33d from the front side of the bottom wall 17, the inflator 31 and the airbag 39 are housed in and attached to the case 12. A connector 36 having the lead wire 37 connected thereto is preliminarily joined with the body 32 of the inflator 31.

[0046]

Subsequently, the individual fixing pieces 68 are applied to the corresponding fixing sections 24, and tapping bolts 25 are fastened into the fixing holes 24a via the fixing holes 68a. Thus the box body 61 of the container box 60 is attached to the case 12. At this time, the support sections 20 and 21 of the case 12 abut against and support the lower surface 64a of the lower wall 64 in the box body 61.

[0047]

Thereafter, the joint sections 26 of the case 12 are secured to the vehicle body 1 by inserting the bolts 27 into joint holes 26a and fastening the same with the nuts 3a, while the fixing pieces 67 of the box body 61 are secured to the vehicle body 1 by fastening the bolts 71 into the nuts 2d via the fixing holes 67a. Thus the case 12 housing the airbag 39 and the inflator 31 and the box body 61 are mounted on

the vehicle. The end of lead wire 37 is connected to a predetermined airbag actuating circuit. By the time of mounting the case 12 and so on on the vehicle, the upper panel 7 of the instrument panel 6 and the airbag device 80 for a front passenger's seat have been mounted on the vehicle in advance. The fixing work of the bolts 27 in the joint sections 26A and 26B is done with the cap 64b open. After fixing the bolts 27, the cap 64b is relocated. In the joint section 26C, the bolt 27 is easily fixed since the under cover 4 has not yet been mounted at this point.

[0048]

If the case 12 housing the airbag 39 and the inflator 31 and the box body 61 are mounted on the vehicle, the module 10 is mounted on the vehicle. At this time, the airbag cover 44 integral with the lower panel 8 is assembled with the case 12. To assemble the airbag cover 44 with the case 12, the walls 47, 48 and 49 of the airbag cover 44 are located around the circumferential wall portion 14 of the case toward the opening 13a. As shown in Figs. 11A and 11B, the retaining hooks 15U are then so inserted into the retaining holes 47a of the upper joint wall 47 as to be retained at peripheries of the retaining holes 47a on the upper surface of the upper joint wall 47. On the other hand, the retaining projections 15D are inserted into the retaining holes 48a of the lower joint wall 48, and the retaining legs 46 are so inserted into the apertures 18b as to be retained at peripheries of the apertures 18b. At this time, the left and right pivot sections 8b are housed in the recesses 69 of the box body 61. Moreover, each of the retaining legs 8d of the lower panel 8 is retained by the lower edge of the upper panel 7.

[0049]

Then as shown in Fig. 11C, the bars 16a of the locking member 16 are inserted between the outer surface of the lower joint wall 48 and the inner circumference of the individual projections 15D, the individual bolts 33d of the inflator 31 are inserted through the locking member 16, and then the nuts 34 are fastened with the bolts 33d. Thus the airbag cover 44 integral with the lower panel 8 is joined with the case 12 to mount the module 10 on the vehicle. Assemblage of the knee-protecting airbag device 11 is complete, too. If the under cover 4 is then attached to the case 12 by means of apertures 18c of the case 12, mounting of the knee-protecting airbag device 11 and the container box 60 on the vehicle is completed.

[0050]

After mounting the knee-protecting airbag device 11 and the container box 60 on the vehicle, when an actuating signal is input to the body 32 of the inflator 31 via the lead wire 37, inflation gas is discharged from the gas discharge ports 32c of the inflator 31, and flows into the airbag 39 via the gas outlet ports 33a of the diffuser 33. Then the airbag 39 inflates and breaks the wrapping film, pushes the doors 52U and 52D of the airbag cover 44, and breaks the breakable portion 51 to open the door 52U upward and 52D downward, respectively about the hinge lines 53. As indicated by double-dotted lines in Figs. 1 and 2, the airbag 39 then protrudes rearward from the opening 54 provided by the opening of the doors 52U and 52D, and further protrudes upward along the rear surface of the lid 73 while expanding and inflating. Accordingly, even if the occupant M seated in the front passenger's seat advances, the inflated airbag 39 is capable of protecting the knees K properly. At this time, since the airbag device 80 for front passenger's seat is actuated, too, the airbag 81 protrudes from the

dashboard 6 to protect the upper body of the occupant M, as indicated by double-dotted lines in Fig. 2.

[0051]

In the occupant protection device S of the embodiment, since the lower panel 8 as an interior decoration member located around the container box 60 except the lid 73 opened/closed when the container box 60 is used, and the airbag cover 44 of the knee-protecting airbag device 11 are formed of a single-piece molded part 56, there appears no parting line in the border of the two members, so that the appearance in the front of the front passenger's seat is improved. Of course, since the lid 73 is separate from the lower panel 8 surrounding the container box 60 and the airbag cover 44, when the opening 61a of the box body 61 of the container box 60 is opened/closed, the lid 73 is capable of swinging smoothly in such a manner as to separate from the lower panel 8 and the airbag cover 44, as indicated by double-dotted lines in Fig. 5. Therefore, the open/close operation is not hindered.

[0052]

In the occupant protection device S of the embodiment, therefore, although the container box 60 is mounted in front of the front passenger's seat while the device aims to protect knees K of the occupant M seated in the front passenger's seat, the device has an improved appearance in the front of the front passenger's seat.

[0053]

Moreover, since two components of the lower panel 8 located around the container box 60 and the airbag cover 44 of the knee-protecting airbag device 11 are formed into a single-piece component, the number of components of the occupant protection device S is reduced, and working processes and cost for mounting the occupant protection device S on

the vehicle are reduced.

[0054]

In the foregoing embodiment, the lid 73 of the container box 60 is assembled with the molded part 56 constituting the interior decoration member or the lower panel 8 surrounding the container box 60 and the airbag cover 44 in order to form the module 10, and the lid 73 is mounted on the vehicle by attaching the module 10 to the vehicle.

[0055]

With this arrangement, since the lid 73 is assembled with the molded part 56 constituting the lower panel 8 located around the lid and the airbag cover 44 in advance, a good appearance is easily retained in a parting line between the lid 73 and the lower panel 8 and the airbag cover 44. Consequently, the appearance of the front of front passenger's seat is improved. Especially, the module 10 constitutes a major part of the front side of front passenger's seat. Since a great part like this is preliminarily assembled before being mounted on the vehicle, good appearance in the front of front passenger's seat is easily retained.

[0056]

Without considering above working-effects, the hinge arms 74 of the lid 73 may be pivotally joined with the case 12 or the like.

[0057]

In the occupant protection device S of the embodiment, the case 12 includes a circumferential wall portion 14 disposed along the circumference of the opening 13a for covering the folded airbag 39, and the circumferential wall portion 14 includes retainers 15 (15U and 15D) protruded outward for joinder with the airbag cover 44. The airbag cover 44 includes: the doors 52U and 52D openable when pushed by the inflating airbag 39; the thinned breakable portion 51 breakable when

pushed by the inflating airbag 39 for allowing the doors 52U and 52D to open; the hinge lines 53 disposed around the doors 52U and 52D to be bent upon opening of the doors 52U and 52D; and the joint walls 47 and 48 attached to the circumferential wall portion 14 of the case 12 by having the retainers 15 (15U and 15D) inserted therein and being held by the retainers 15 (15U and 15D).

[0058]

Moreover, the molded part 56 integrating the lower panel 8 and the airbag cover 44 is a two-color molded part of a soft material and a hard material compatible to each other. The doors 52, the hinge lines 53, the breakable portion 51, and the joint walls 47 and 48 of the airbag cover 44 is included in the soft section 57 made from the soft material, whereas the remaining region is included in the hard section 58 made from hard material.

[0059]

In such molded part as 56, when the doors 52 of the airbag cover 44 are pushed by the inflating airbag 39 and open while breaking the breakable portion 51 disposed therearound, the doors 52 do not break although they may be pushed and deformed, but are elastically deformed and smoothly open since they are of the soft section 57. Moreover, the hinge lines 53 also bend easily, since they are of the soft section 57. Consequently, the doors 52 open smoothly and allow the airbag 39 to deploy smoothly. Besides, since the joint walls 47 and 48, by which the airbag cover 44 is attached to the circumferential wall portion 14 of the case 12, are also the soft section 57, the walls 47 and 48 are elastically deformed and prevent peripheries of the retaining holes 47a and 48a holding the retainers 15U and 15D of the circumferential wall portion 14 from breaking if subjected to a strong tensile force

when the doors 52 open. Of course, since the remaining region of the two-color part 56 such as the general section 45 of the airbag cover 44 apart from the doors 52 and lower panel 8 belong to the hard section 58 having rigidity, the two-color part 56 is capable of keeping a predetermined shape easily. Without considering the high rigidity, the whole airbag cover 44 including the general section 45 may be constituted by the soft section 57. Further alternatively, the whole molded part 56 including the lower panel 8 may be fabricated of a soft synthetic resin material such as thermo-plastic elastomer.

[0060]

In the foregoing embodiment, moreover, the box body 61 is abutted on and supported at its lower surface 64a of the lower wall 64 by the support sections 20 and 21 protruded upward from the case 12. Here, since the case 12 is made of rigid sheet metal, and is secured to the vehicle body 1 tightly so that the inflating airbag 39 may smoothly protrude from the opening 13a, the lower wall lower surface 64a of the box body 61 is securely supported by the support sections 20 and 21. Accordingly, even if heavy objects are housed in the boxy body 61, the box body 61 is prevented from deforming, and thus is able to keep good appearance. Especially, since the support sections 20 and 21 support the lower surface 64a of the lower wall 64 in the box body 61 widely in the transverse direction at the front edge 64c side and the rear edge 64d side, the box body 61 is stably supported.

[Brief Description of the Drawings]

Fig. 1 is a front view of an occupant protection device embodying the present invention as mounted on the vehicle, as viewed from rearward of the vehicle;

Fig. 2 is a schematic vertical section of the occupant protection

device of the embodiment as mounted on the vehicle, taken along the front-rear direction of the vehicle;

Fig. 3 is a schematic enlarged vertical section of a knee-protecting airbag device of the embodiment;

Fig. 4 is a schematic enlarged cross section of the knee-protecting airbag device of the embodiment;

Fig. 5 is a partial sectional view illustrating the open-close operation of a lid of a container box of the embodiment;

Fig. 6 is a schematic front view of the occupant protection device of the embodiment;

Fig. 7 is a schematic cross section of the container box of the embodiment, taken along the line VII-VII of Fig. 6;

Fig. 8 is a schematic vertical section showing the joined condition of the knee-protecting airbag device of the embodiment and the vehicle body, taken along the line VIII-VIII in Fig. 6;

Fig. 9 is a schematic partial section showing the way an airbag cover and a lower panel of the embodiment are continuous, taken along the line IX-IX in Fig. 6;

Fig. 10 is an exploded perspective view of the container box and a case of the knee-protecting airbag device of the embodiment; and

Fig. 11 illustrates a mounting work of the airbag cover of the embodiment on the case.

[Description of the Reference Numerals]

8 ... (interior decoration member) lower panel

10 ... module

11 ... knee-protecting airbag device

12 ... case

13a ... opening

31 ... inflator
39 ... airbag
44 ... airbag cover
56 ... molded part
60 ... container box
61 ... box body
61a ... opening
73 ... lid
M ... vehicle occupant
K (KL, KR) ... knee
S ... occupant protection device



Fig. 1

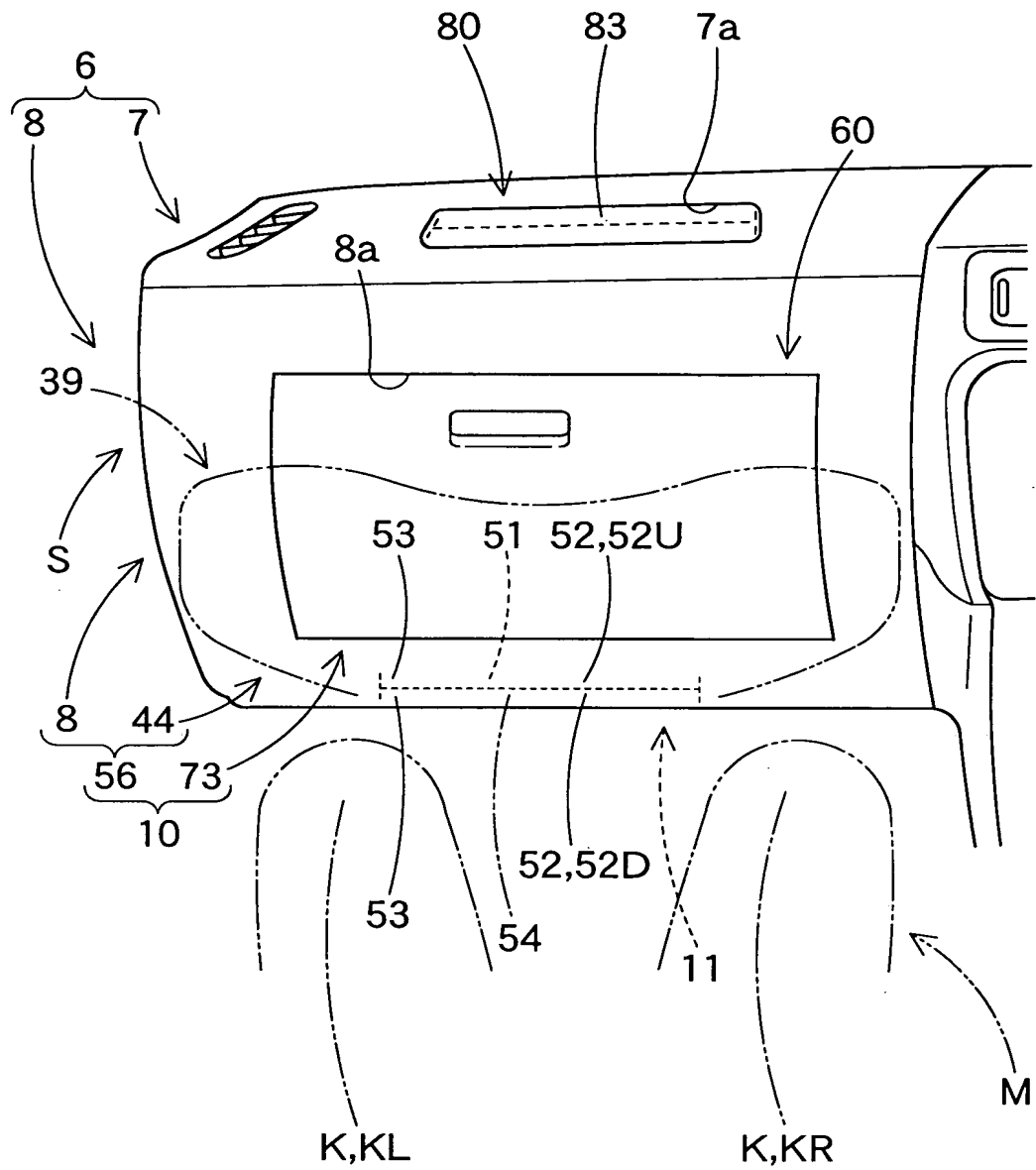


Fig. 2

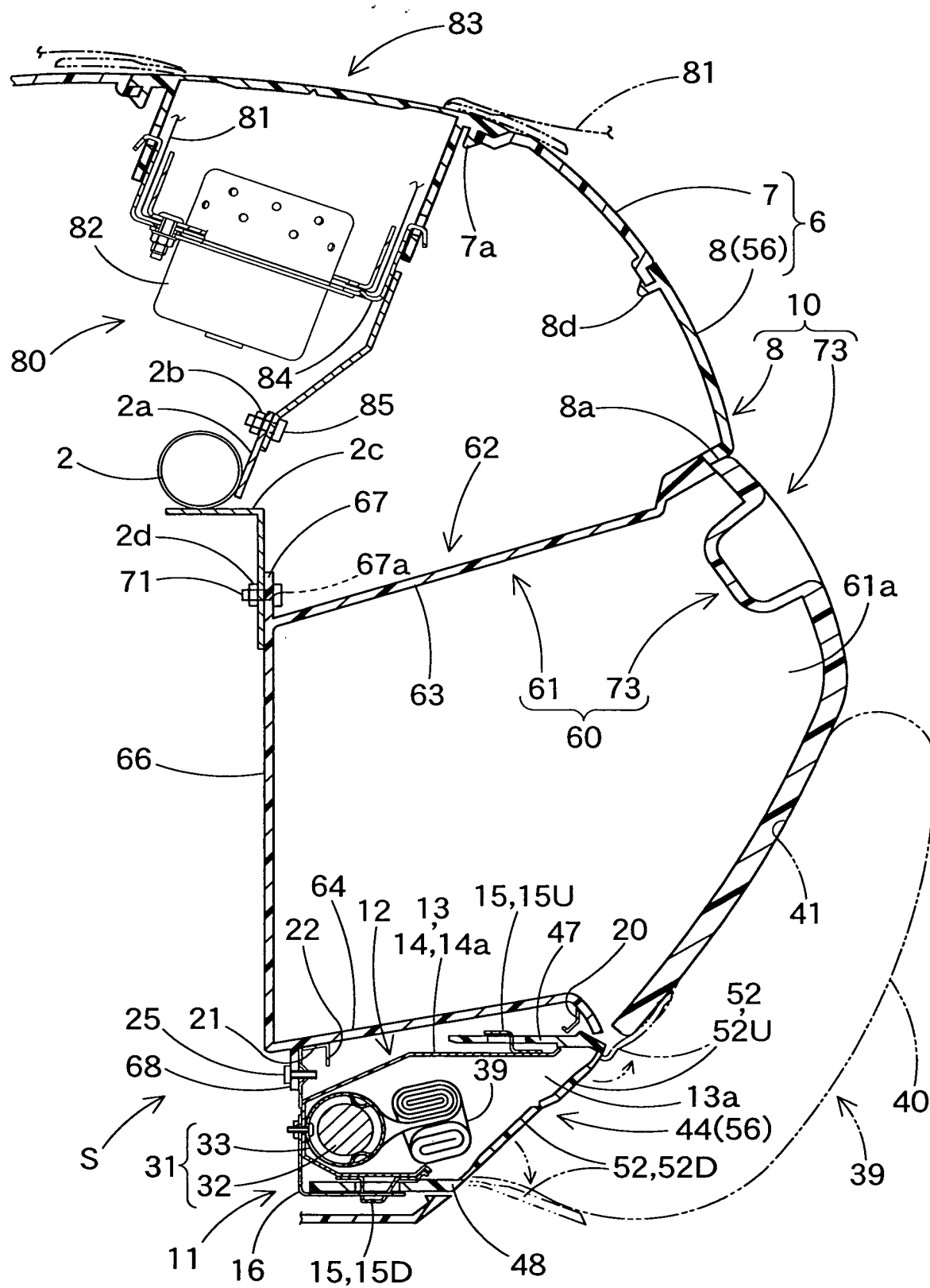


Fig. 4

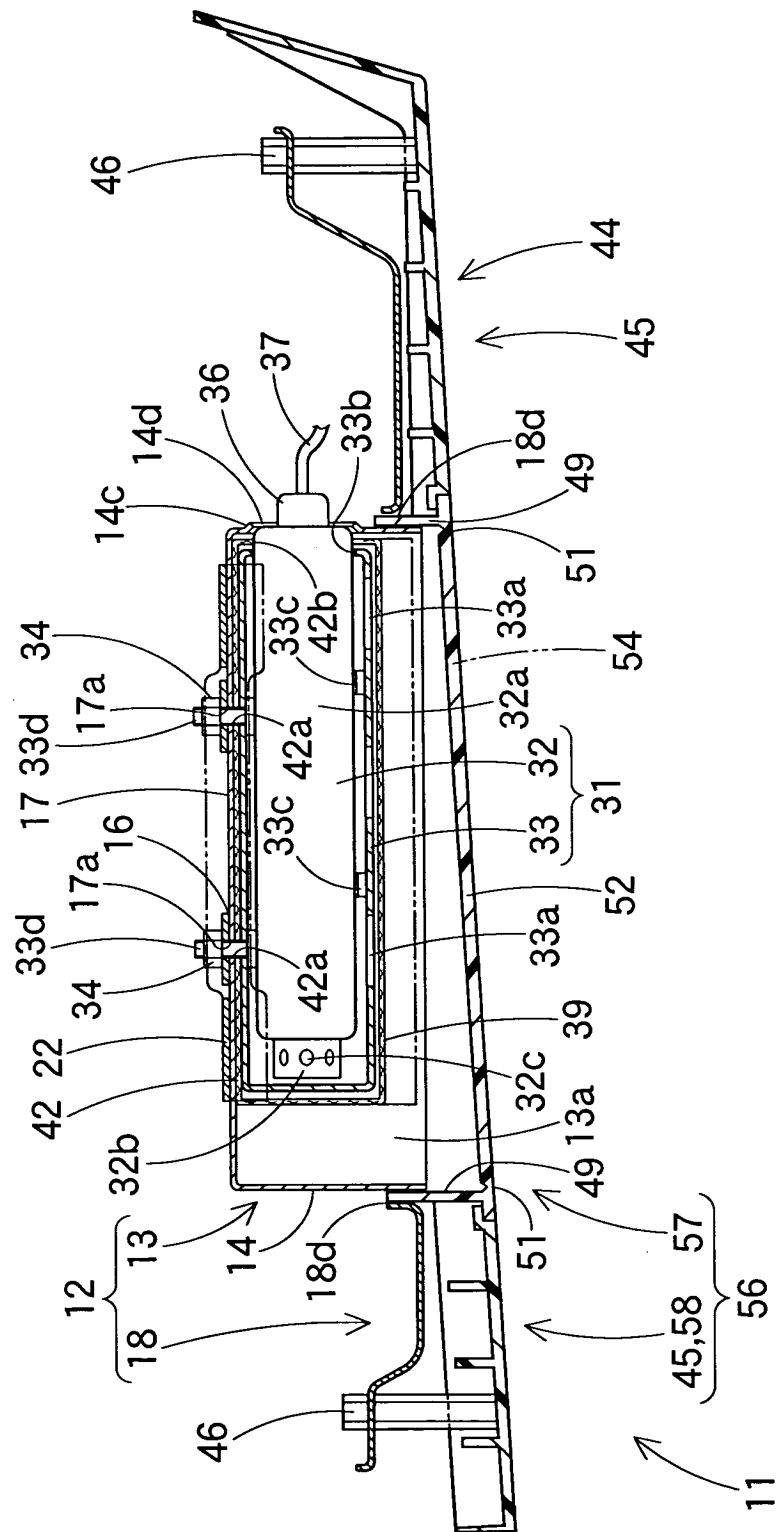


Fig. 5

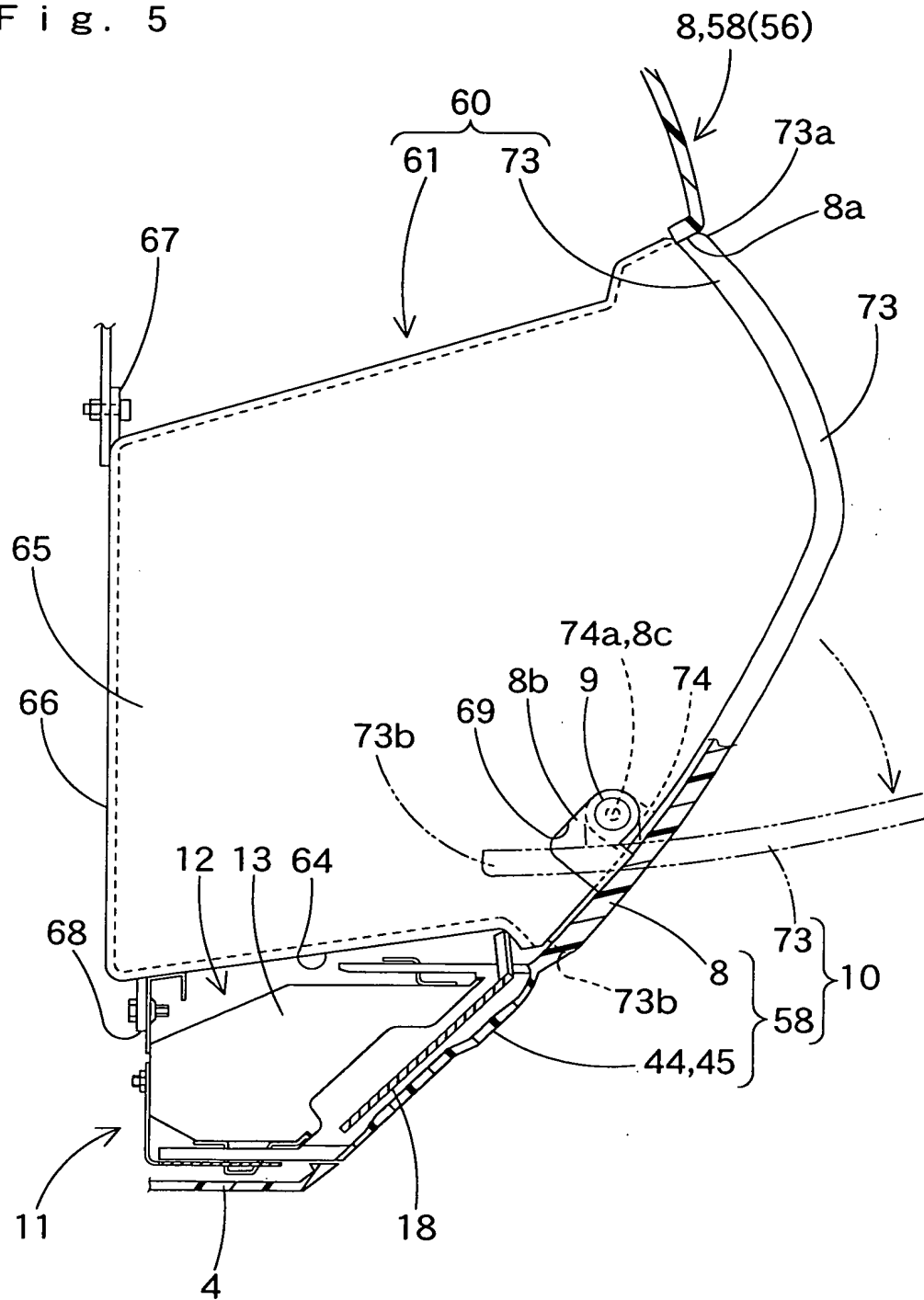


Fig. 6

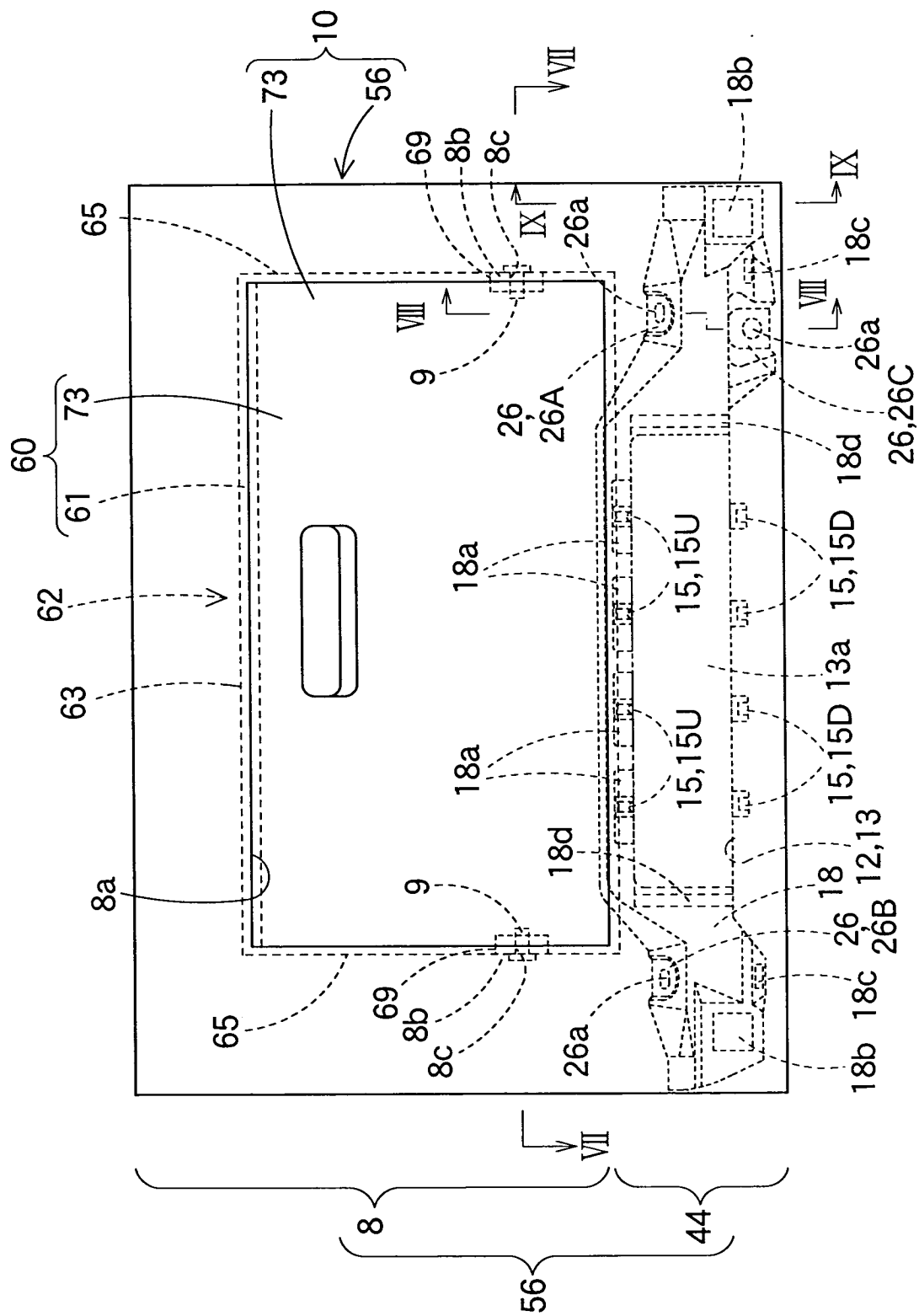


Fig. 7

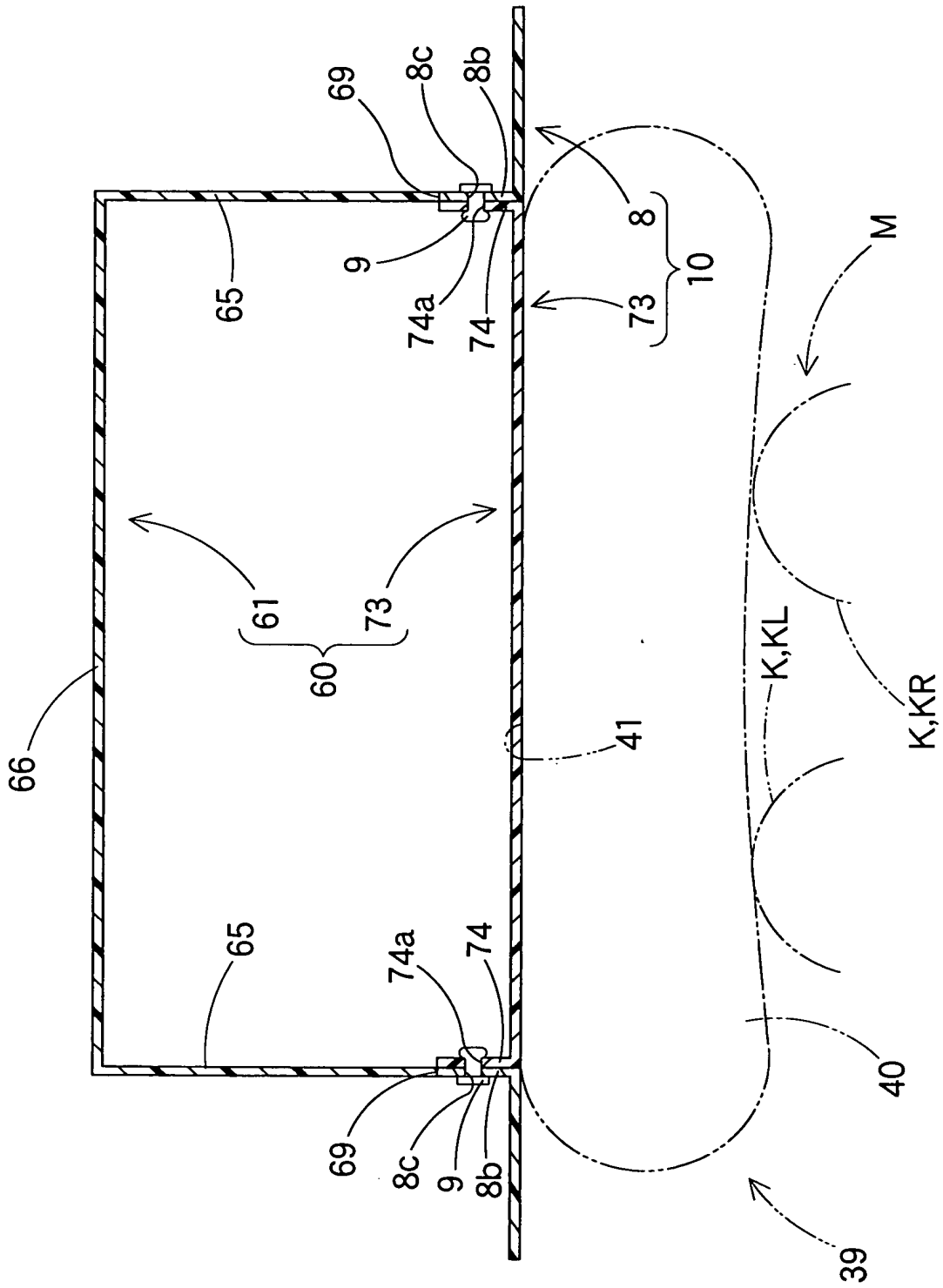


Fig. 8

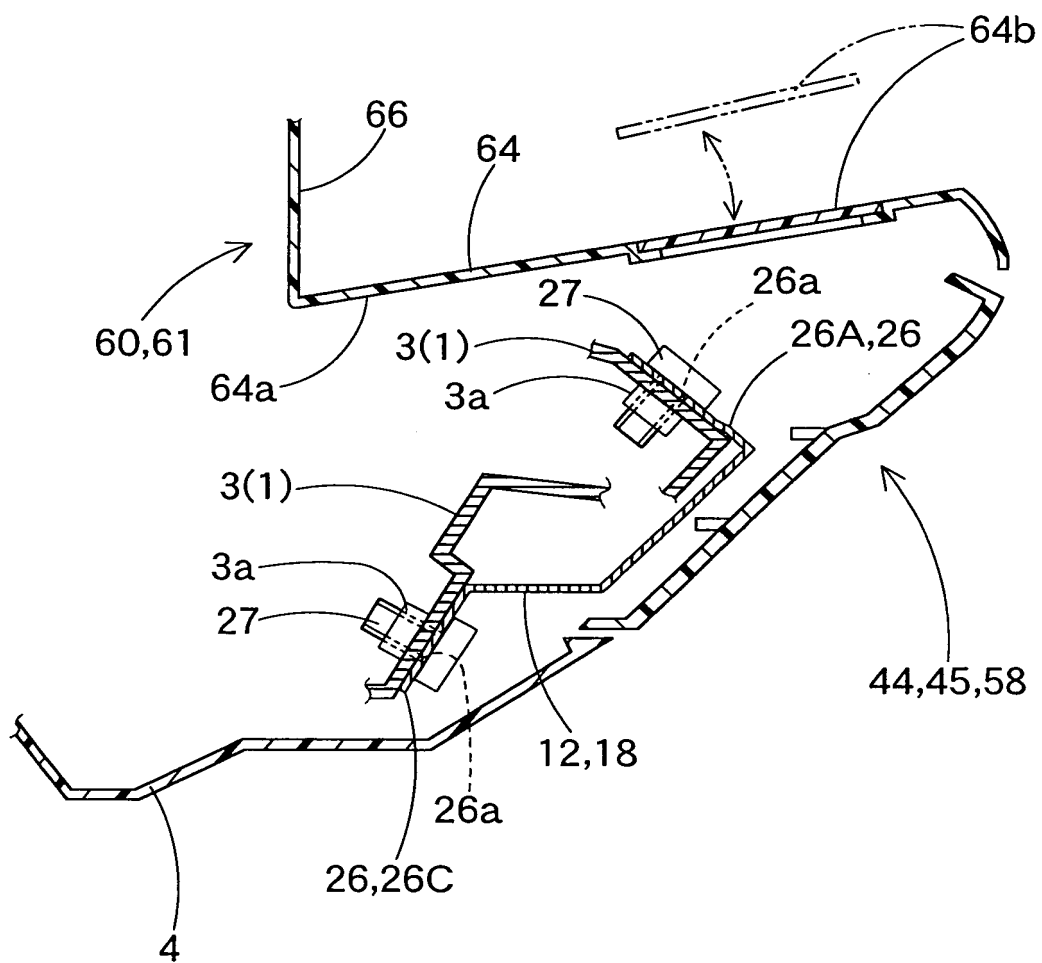


Fig. 10

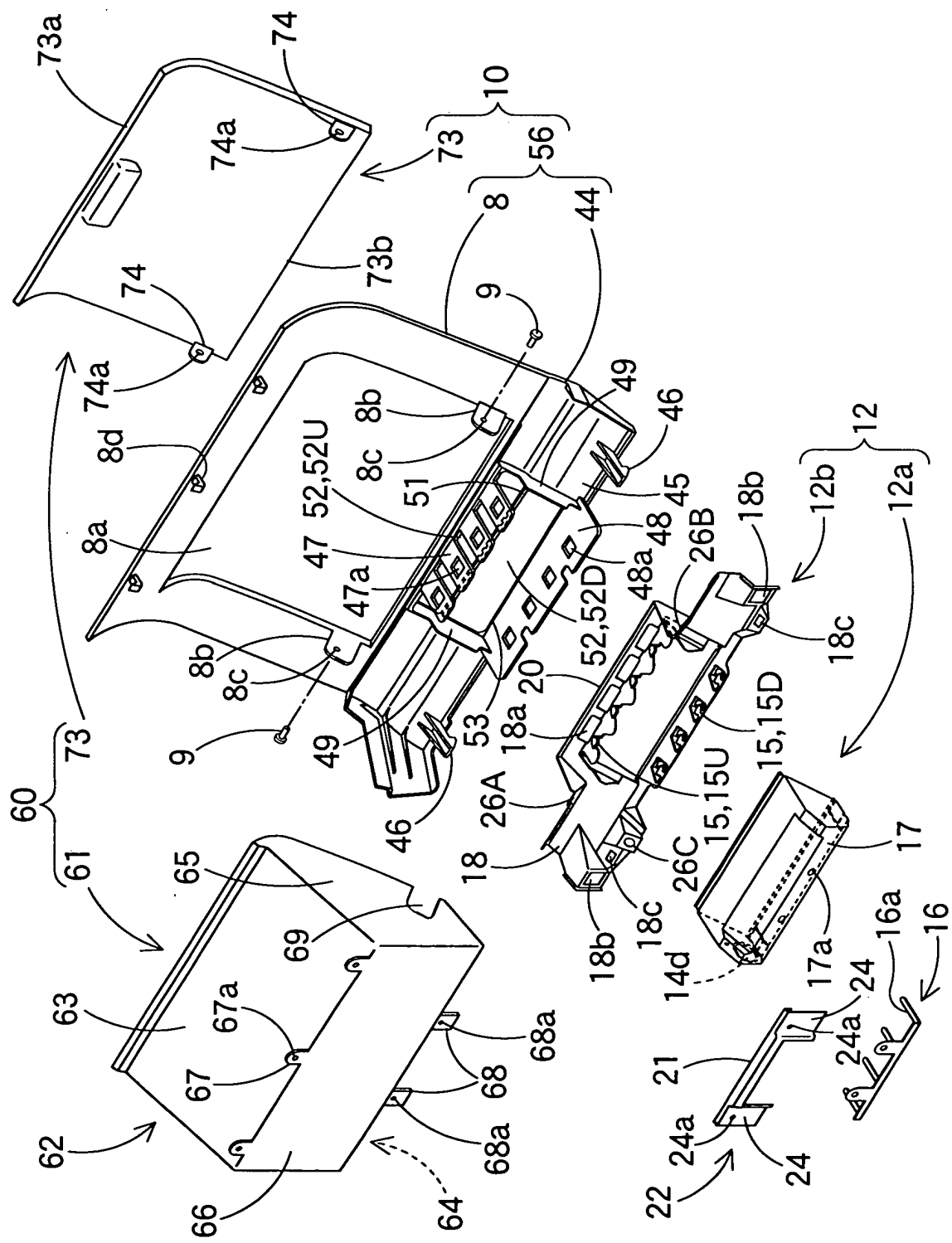


Fig. 10

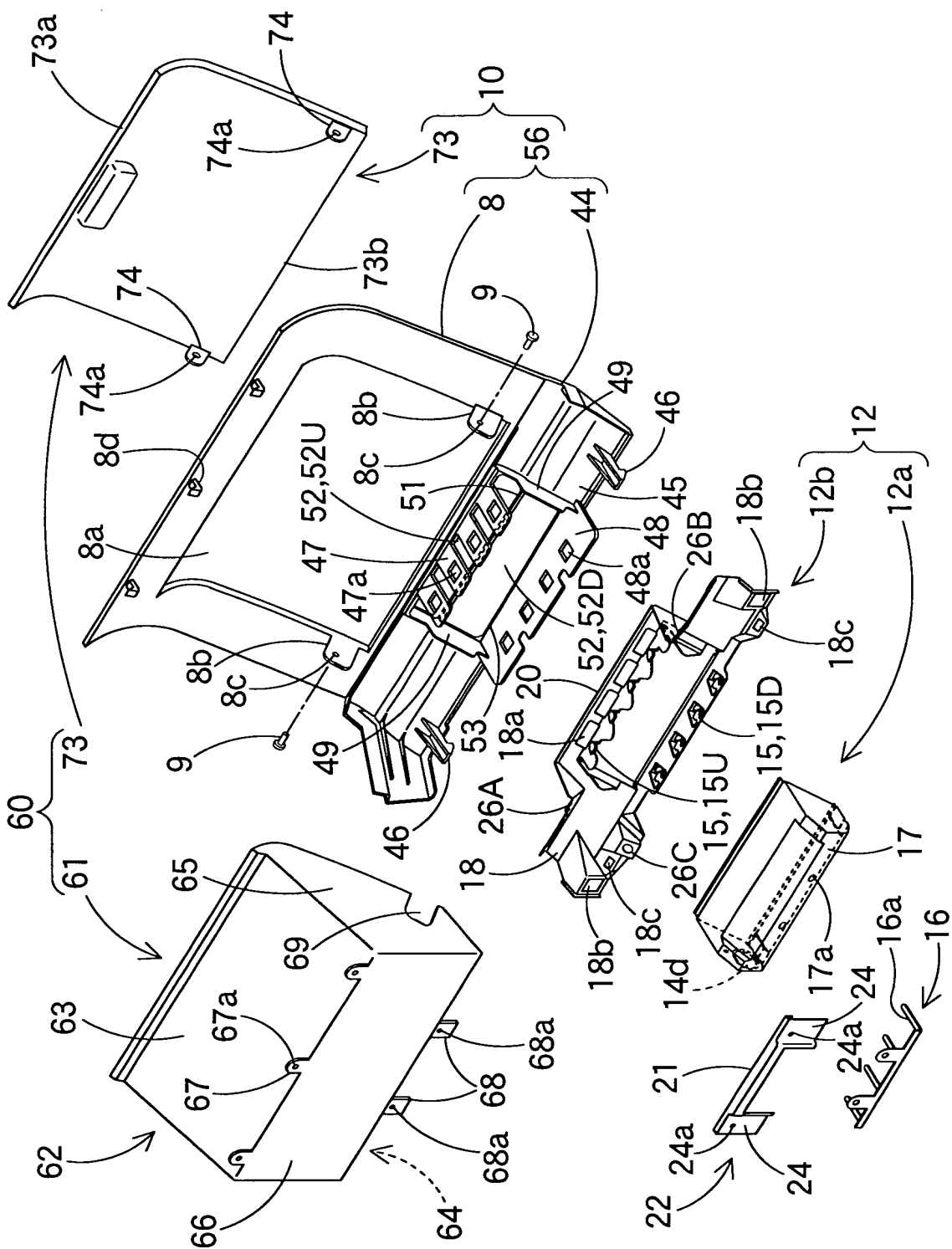
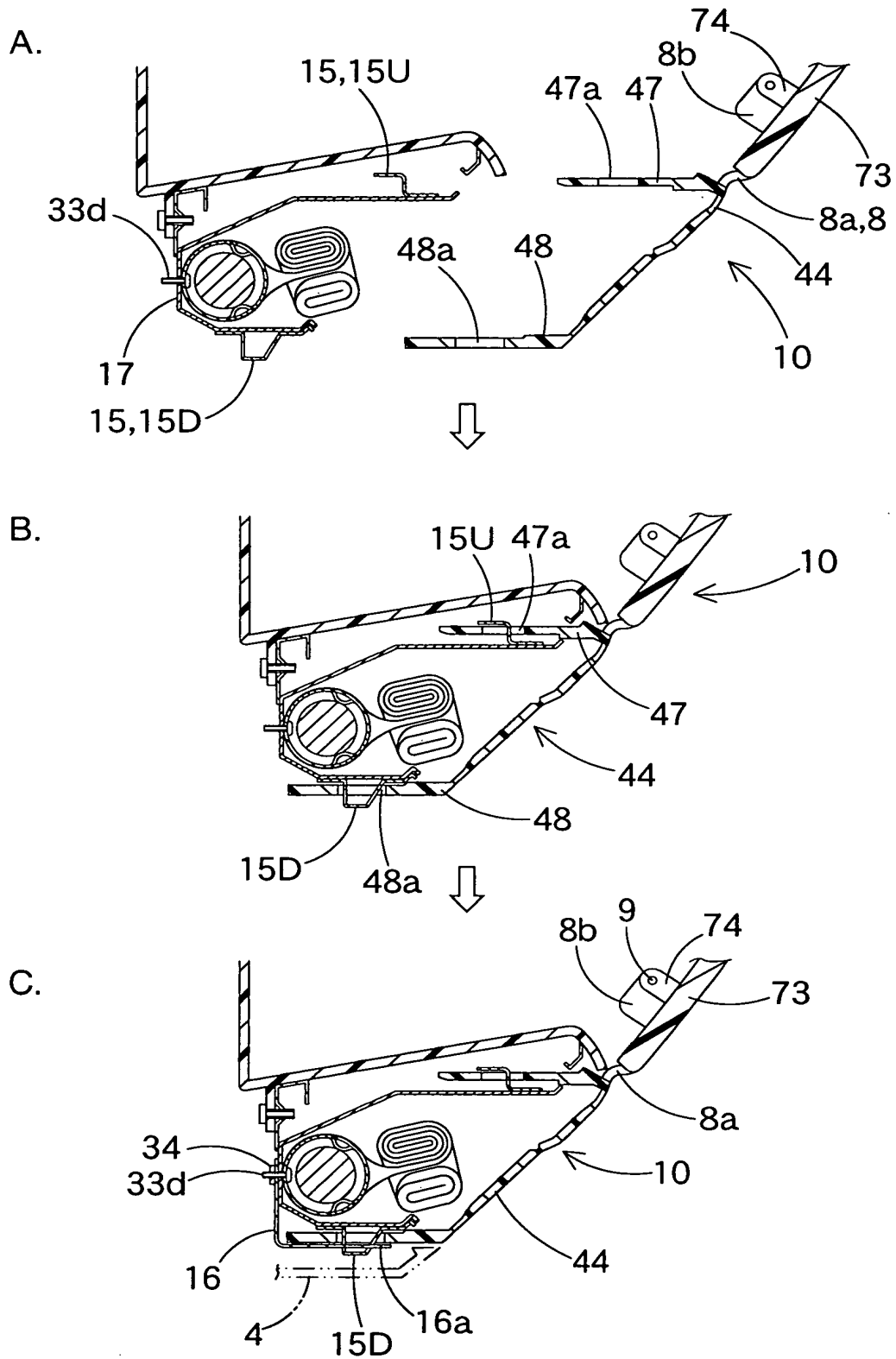


Fig. 11



[Name of the Document]

Abstract of the Disclosure

[Abstract]

[Task] To provide an occupant protection device which has an improved appearance in the front of the front passenger's seat even if a container box is mounted in front of the front passenger's seat while the device aims to protect knees of an occupant seated in the front passenger's seat.

[Means of Solving the Problem]

The occupant protection device S includes a knee-protecting airbag device 11, a container box 60 located above the airbag device 11 for housing goods, and an interior decoration member 8 surrounding a rear side face of the container box. The airbag device 11 has an airbag 39, an inflator 31, a case 12 for housing the airbag and the inflator and which is opened rearward, and an airbag cover 44 for covering an opening 13a of the case 12 in an openable manner. The container box 60 includes a box body 61 opened rearward and a lid 73 covering an opening 61a of the box body 61 in an openable manner. The interior decoration member 8 and the airbag cover 44 are made of a single-piece molded part 56 which is integrally molded.

[Selected Drawing]

Fig. 2